



Università Roma 3  
Presentazione agli studenti  
Roma - 31/05/2011

# Applicazione del Web Semantico alle Imprese

CNR-IASI  
LEKS – Laboratory for Enterprise  
Knowledge and Systems  
**Francesco Taglino**

# LEKS – Laboratory for Enterprise Knowledge and Systems

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- **Spin-off** from the Research Area: Information Systems and Knowledge Bases
- **Founded** in November 1999
- **Goal:** experiment scientific results, test software tools, participate to applied projects
- **Staff:** ca 10 p, including consultants, students and external co-operations
- **Funding:** mainly from projects and private grants

# Research Themes

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- Knowledge representation and reasoning
- Ontology building methodology
- Semantic Interoperability
- Semantic annotation or enterprise resources
- Semantic search and retrieval
- Semantic Similarity
- Enterprise Ontology
- Semantic business processes

# Achievements in Semantics-based methodologies and tools at IASI

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- **Ontology modelling** (OPAL conceptual patterns)
  - Ontology Management System: Athos and Prothos, a Protege plug-in implementing OPAL
- **Ontology engineering** (UPON and SOBE)
  - Based on automatic knowledge extraction and social participation for consensus reaching
- **Semantic annotation.** Method and platform for:
  - Structured documents: for transformation rules building
  - Unstructured resources: based on **Ont Feature Vectors** technique

# Achievements (Cont'd)

- **Semantic Reconciliation** of business documents (SemRecSuite)
- **Semantic Similarity Reasoning Engine** (*Semsim*) and **Semantics Search and Retrieval**, based on ontologies and information theory.
- **Semantic Business Processes** (BPAL) modeling, search and reasoning
- **Ontology-based Bayesian Reasoner** for Situation Awareness (application to Maritime Surveillance)
- **Semantics-based Social Media**: Grapevine
- Semantic **3D** Virtual collaboration spaces

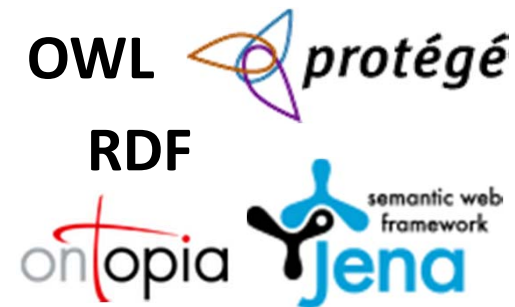
# Adopted technologies

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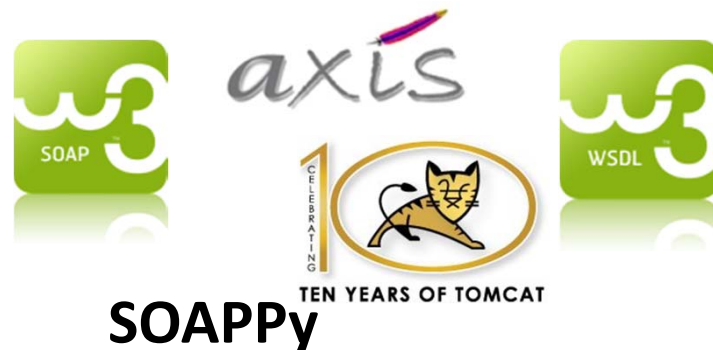
## Software development



## Semantics-based Languages and tools



## Web Services



## Business Process modelling and execution



# Long experience in European and National Research Projects

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Project name: **BIVEE** - Business Innovation and Virtual Enterprise Environment - FP7-NMP-ICT-FoF (2011-2014)

- Description: The BIVEE project intends to develop a rich framework, i.e., a software environment that includes business principles, models, and best practices, to promote innovation in virtual enterprise environments.

Project name: **ENSEMBLE** - Envisioning, Supporting and Promoting Future Internet Enterprise Systems Research through Scientific Collaboration - FP7-ICT- 257548 (2010-2012)

- Description: ENSEMBLE combines systemic approaches, scientific multi-disciplinary, innovative Web 2.0 collaboration tools with a community-driven mentality, to significantly increase the impact of the future internet enterprise systems domain

# Projects (cont'd)

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Project name: **COIN** - COllaboration and INteroperability for networked enterprises - IP, Integrated Project - FP7-IST216256 (2008-2011)

- Description: The project aims to integrate, compose and mash-up in a secure and adaptive way existing and innovative to-be developed Enterprise Interoperability and Enterprise Collaboration services

Project Name: **SITMar** – Situation Awareness in Maritime Monitoring

- Description: A Bayesian reasoner for the early discovery of pirates' attacks in the Gulf of Aden. In collaboration with Consortium START and Finmeccanica.

Project name: **FIRB TOCAI.IT** - Tecnologie Orientate alla Conoscenza per Aggregazioni di Imprese in Internet (2006-2010)

- Description: The project aims at developing an integrated group of methodologies, techniques, and software systems based on the most advanced knowledge technologies and suitable to perform on-the-field analysis, specification, implementation, and evaluation of new enterprise organization models in the “internetworked enterprise” perspective



# Projects (cont'd)

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Project name: **SINERGIA** (2008-2009)

- Description: Sistema innovativo di evoluzione delle tecnologie di Rete per la Gestione Industriale dell'Azienda

Project name: **ONTOMAN** (2007-2008)

- Description: Metodologia per la costruzione di bridge sulla base di ONTologie di dominio della MANutenzione impianti industriali

Project name: **LEMAIA** - Learning Educational Methodologies: An Innovative Approach (eLearning Programme EACEA, 2007-2008)

- Description: The project's objective is to provide information and digital literacy on eLearning in collaboration with subject specialists. To this end, it aims at creating a community of teachers developing and exchanging learning objects across Europe by using advanced tools as knowledge management systems and ontology-based tools<sub>9</sub>

# Projects (cont'd)

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Project name: **LD-CAST** - Local Development Cooperation Actions enabled by Semantic Technology - FP6-2004-IST-4 No. 26919 (2006 – 2008)

- Description: The project aims at enabling cross border cooperation between European chambers of commerce, in order to support the development of private company initiatives.

Project name: **ONTODEV** - Ricerca su metodologie e tecnologie per il governo dei processi di sviluppo: strategia, progetto e comunicazione. Soluzioni per la descrizione e gestione della conoscenza nel dominio dell'innovazione per lo sviluppo del territorio (2006-2007)

- Description: Realization of an ontology-based knowledge management platform for supporting territorial development projects

Project name: **ATHENA** - Advanced technologies for interoperability of heterogeneous enterprise networks and their applications - FP6-IST-2002-2.3.1.9 (2004-2007)

- Description: ATHENA aims to be the most comprehensive and systematic European research initiative in IT to remove barriers to interoperability, to transfer and apply the research results in industrial sectors, and to foster a new- networked business culture.

# Projects (cont'd)

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Project name: **INTEROP** - Interoperability Research for Networked Enterprises Applications and Software – FP6- IST-2003-508011 (2003-2007)

- Description: Network of Excellence on the ESA interoperability; an instrument for strengthening excellence of European research in interoperability of enterprise applications, by bringing together the complementary competences needed to develop interoperability in a more global and innovative way.

Project name: **HARMONISE** - Tourism Harmonisation Network - FP5 - IST- 2000-29329 (2003-2005)

- Description: definizione di una piattaforma ontology-based per l'interoperabilità delle PMI europee nel settore turistico.

Project name: **WEB LEARNING** - Web Learning per la qualita' del capitale umano (2003-2004)

- Description: Study, design and development of methods and tools for web learning, aimed at facilitating the information literacy.

# European and National projects

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## E-Learning

**LEMAIA**

Web Learning

Enterprise  
interoperability

**COIN**

**ATHENA**

**NoE Interop**

**Ontoman**

**SW2S**

## E-Government

**LD-CAST**

**OntoDev**

**eGov**

Virtual Enterprise  
Innovation

**BIVEE**

## Semantic Business Processes

**TOCAI**

**SINERGIA**

## Ambient Assistant Living

**HOPES**

**European projects**

**National projects**

# COIN

Enterprise **C**ollaboration & **I**nteroperability



# COIN European research project

Collaboration and Interoperability for networked enterprises

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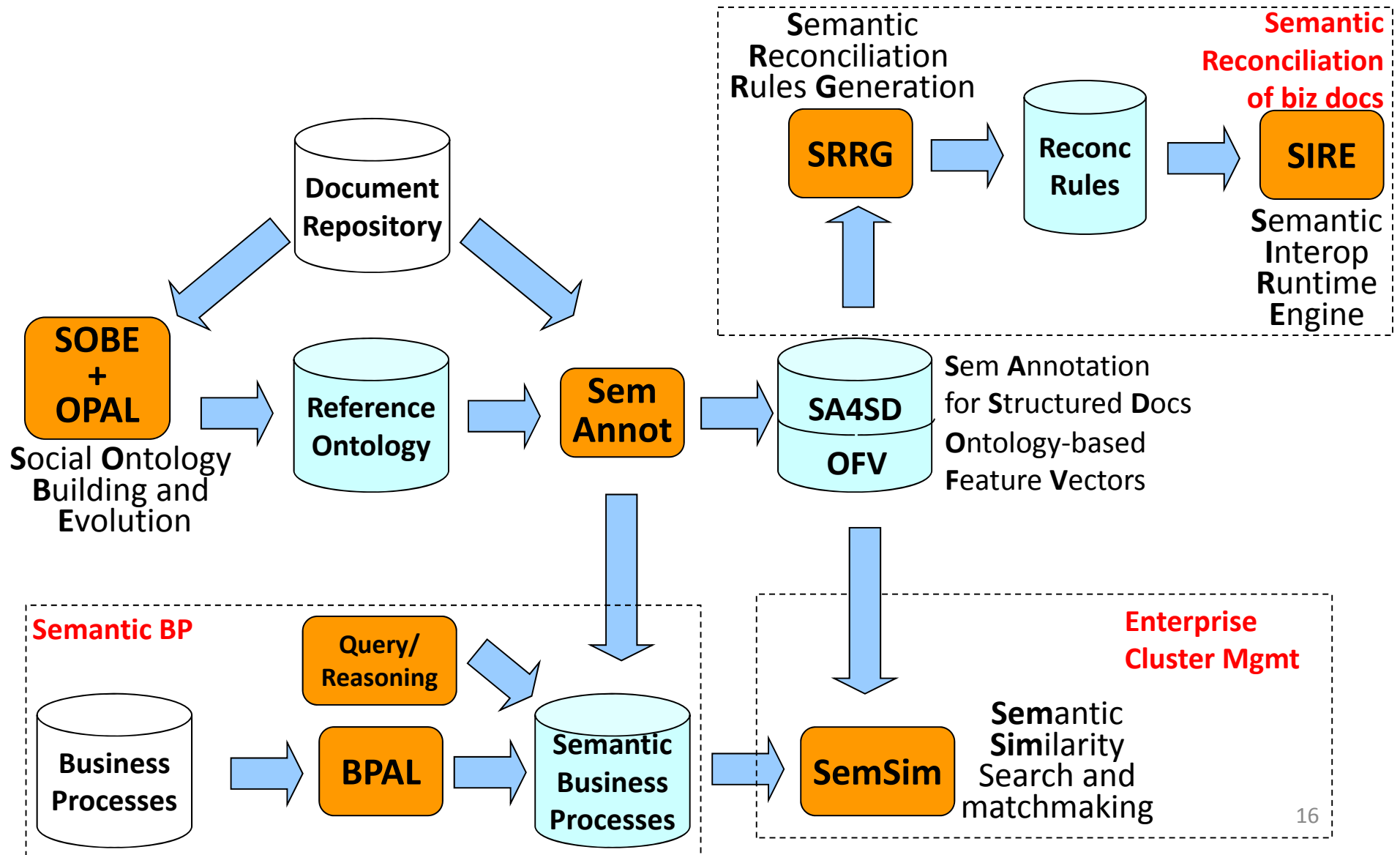
- **Information Interoperability:** Semantic Reconciliation of Business Documents
- **Knowledge Interoperability:** Semantic management of competences and skills in an enterprise cluster

# Semantic Interoperability of Business Documents

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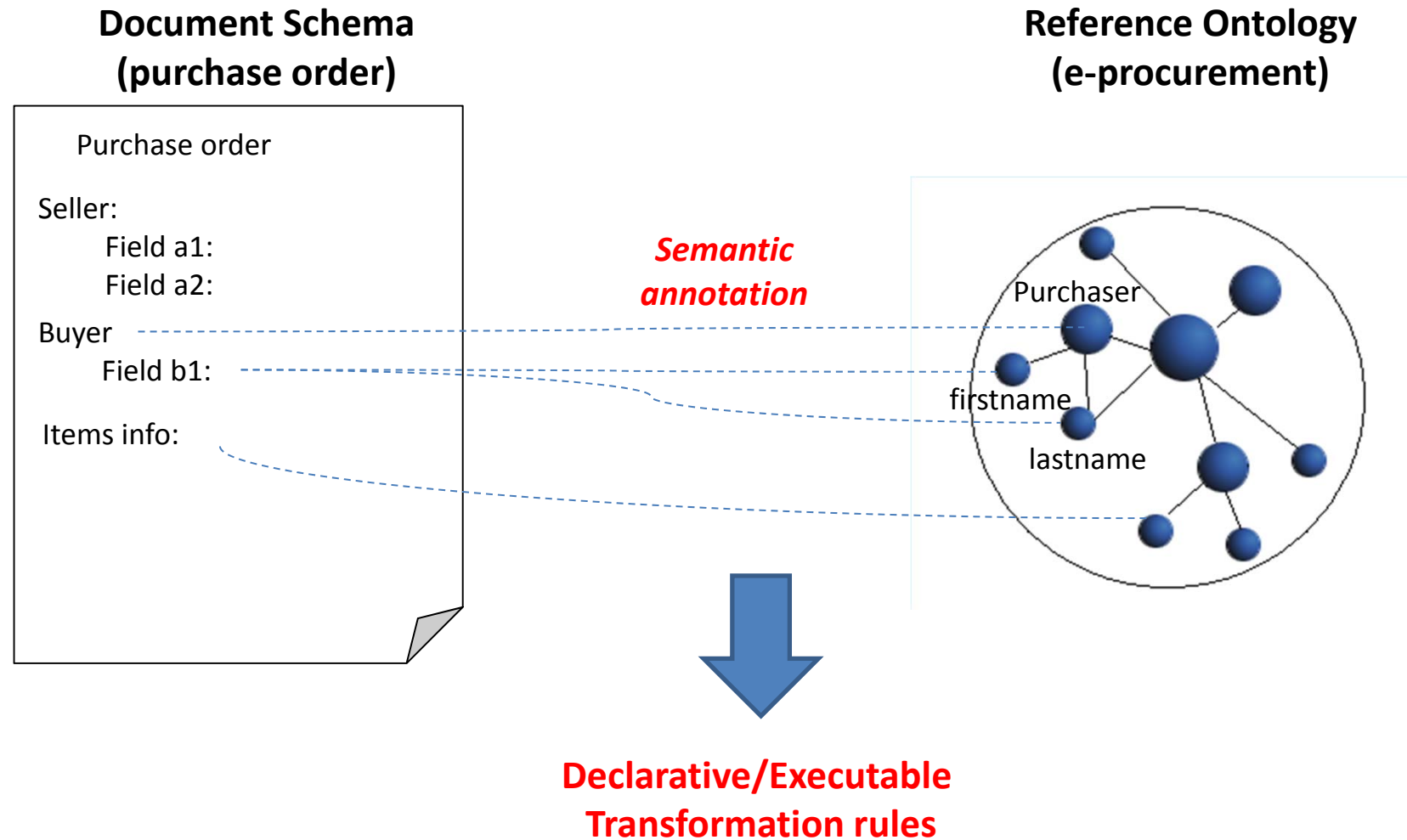
- **Documents exchange** among heterogeneous software applications
  - different terminology
  - different data structure and organization
- **No ad-hoc adapters** between pairs of applications (high maintenance costs)
- A **reference ontology** for semantic mapping of internal data structures
  - **Semantic annotation** (declarative mapping)
  - **Transformation rules** (operational mapping)

# Macro-architecture of Semantics-based Infrastructures developed by IASI





# Semantic annotation of structured documents for doc exchange



# Enterprise Knowledge Interoperability

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Exploit at best the knowledge of each cooperating enterprise (**C**ollaborative **N**etwork), leveraging on their complementarities, avoiding unnecessary overlapping.

- Focussing on Competences and Skills (**CS**)
- Modelling the knowledge asset of a CN (**CS ontology**)
- Building **semantic profile** of companies in the CN
- Identifying through similarity-based techniques
  - **Missing CS** (e.g., to be acquired with new partners) with respect to the needed CS
  - **Complementarities** among companies



# **BIVÉE**

## **Business Innovation in Virtual Enterprise Environment**

European Project under 'Factory of  
the Future'

FP7 – Call 7, Objective 7.3

# Objectives of BIVEE

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Two levels objectives:

- Continuous **improvement** of the production
- Continuous **innovation** in products, strategies, processes, organization, etc.

To this end:

- Create a **knowledge-based infrastructure** to promote and support business and enterprise improvement and innovation
- Operate in the **manufacturing** sector
- Assuming **networked enterprises**

# Key issues

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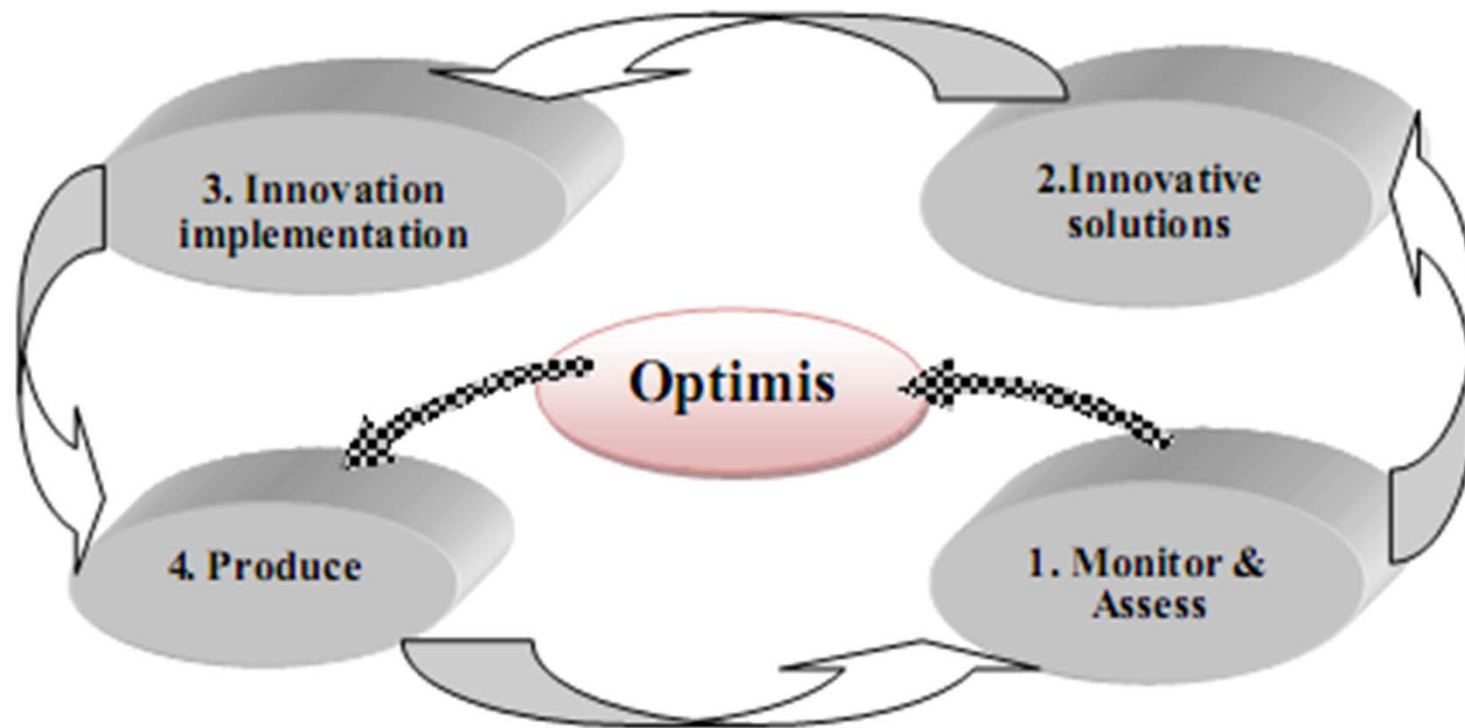
- Keep under control the **flow of material** and **information** in the network of enterprises
- Identify possible **bottlenecks** and hindrances
- Explore the **improvement options**, even when all runs smoothly, and support the decision

## **Innovation:**

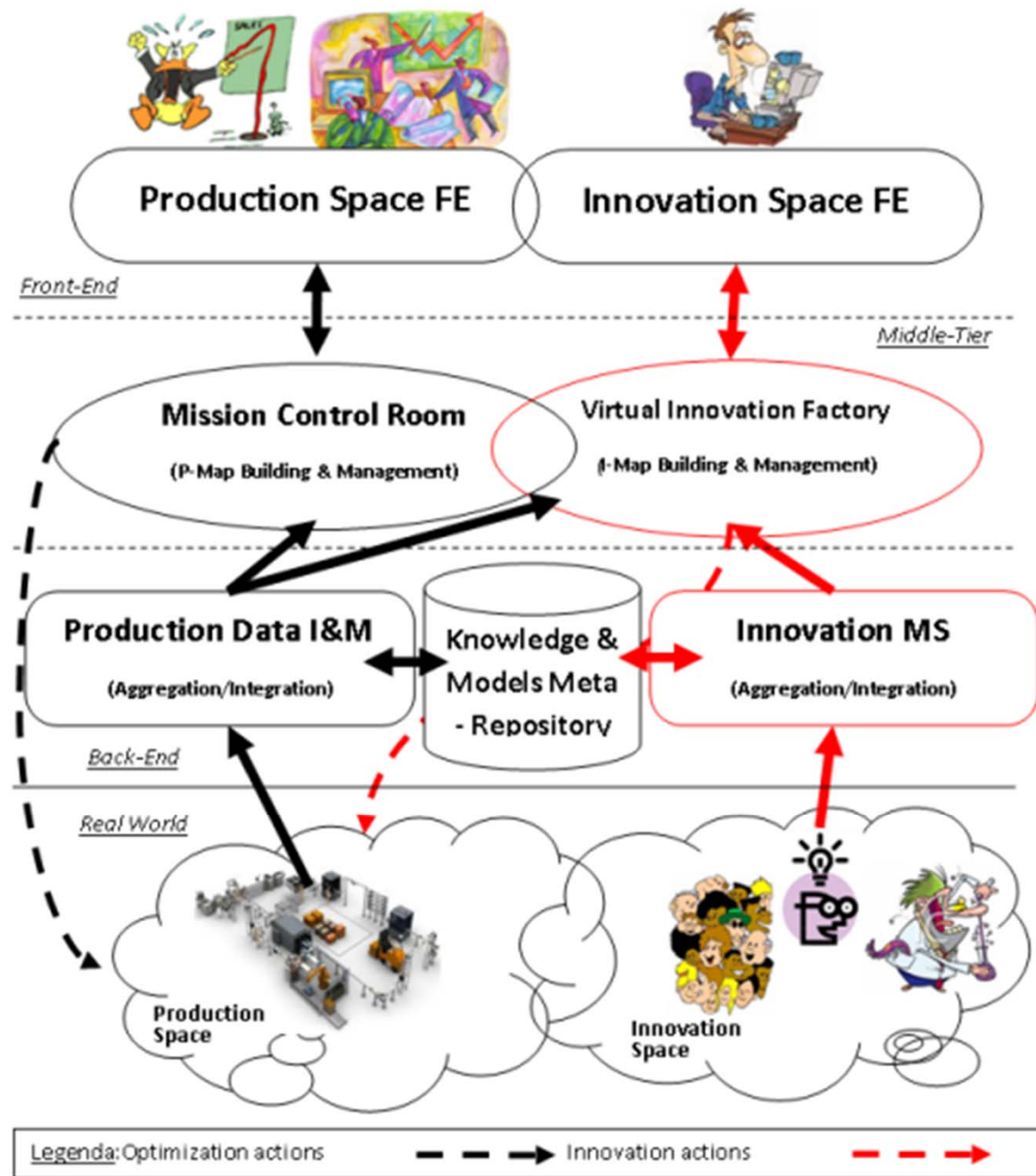
- create a **bank of ideas**, internally and externally produced
- Innovation lifecycle: from the idea, to its assessment, until its implementation and deployment

# Improvement – Innovation Cycles

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# General view of BIVEE Architecture





# Virtual Mission Control Room

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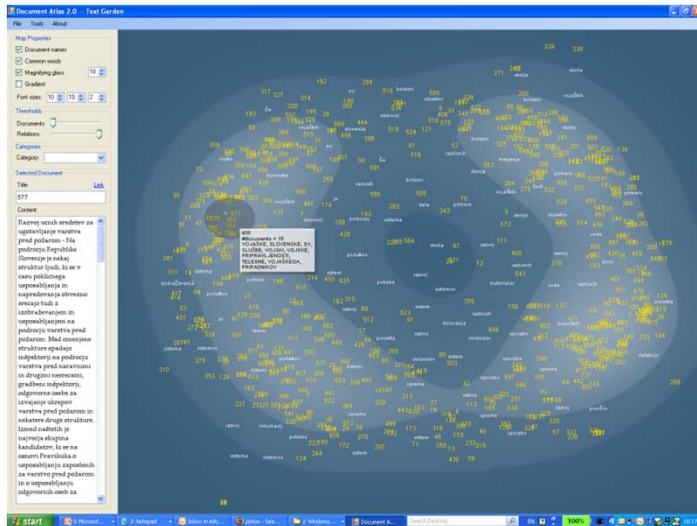
<http://labs.oracle.com/projects/mc/mpk20.html>

# Virtual Knowledge Space

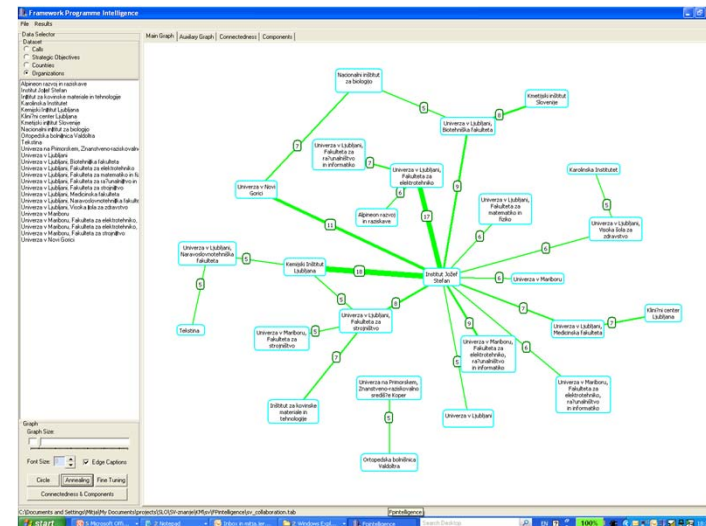
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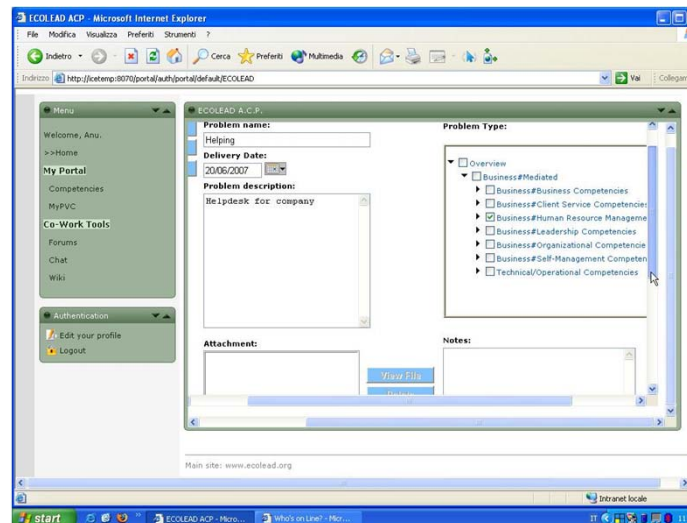
# Open Collaborative Innovation



Detecting innovation needs



Monitoring innovation groups



Collaborative problem solving

# Methods and tools for enterprise knowledge representation/management

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## Method

- **OPAL** (Object Process Actor Language) for **business oriented ontology modelling**

## Tool

- **PROTHOS**, a **Protege plug-in (Java/Swing)** for enterprise ontology modelling

## Semantic Business Process Management

- Semantic BP query
- BP rules
- BP interoperability

# Semantic Web in the social networks

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- Social application in the **Web 2.0** for improving the quality of the life
- **Digital convergence**, including SMS (Text Msg)
- **Geo-referencing & Semantic GIS** : **semantic annotation of geographical maps** (e.g., openstreetmaps, googlemaps)
- Ontology-based **Opinion mining**

# Thesis proposals

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- Automatic semantic profiling (Ontology-based Feature Vectors, OFV)
  - **Automatic semantic profiling** algorithm
  - Analysis of different **knowledge extraction approaches** from unstructured documents
  - **Weighting OFV** (relevance and intensity of features)
- Semantic Matchmaking
  - **Semantic similarity**
  - **Semantic Search and retrieval**

# Semantic Reconciliation: thesis proposals

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- Mapping Discovery
  - Checking a domain ontology to **add meaning to** different parts of a **structured document** (e.g., invoice, purchase order)
- Reconciliation Rules Generation
  - Schema documents gap analysis and **synthesis of mapping rules**
- Interactive user interface
  - Development of a **web application** (Java/GWT) for a semantic reconciliation tool

# Contacts

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